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Casualties as a Measure of

the Loss of Combat Effectiveness

of an Infantry Battalion

Operating Under
Contract with the

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ARMY

Casualties as a Measure of

the Loss of Combat Effectiveness

of an Infantry Battalion

by

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PROBLEM

To investigate from actual combat data the validity of the statement that a unit may be considered no longer combat effective when it has suffered N percent casualties.

FACTS

Of the several variables which may affect the combat effectiveness of a military unit, only daily variations in numerical strength can be quantified. Casualty and replacement data from the morning reports of 44 infantry battalions taking part in seven engagements in World War II in the ETO were compiled and analyzed. Eleven other variables were also noted, and their contributions in the engagements studied.

DISCUSSION

The statement, frequently made, that a unit loses its combat effectiveness when it loses a certain percentage (usually given as 20-30 percent) of its men was felt to be an oversimplification which required careful definition, if indeed it had basis in fact. Loss of combat effectiveness is defined as the inability of a unit to fulfill its mission. The onset of this inability is termed a "breakpoint." Three categories of breakpoint are premised on the basis of the type of mission assigned the unit and the degree of its inability to perform that mission. Occurrences of these categories of breakpoint were compiled from the experience of the battalions studied.

Categories of Breakpoint

I. Attack → rapid reorganization → attack
II. Attack → defense
III. Defense → withdrawal by order to a quieter sector*

* The sample representing defense to collapse had to be discarded and III was substituted in the belief that casualty levels associated with such breakpoints represent lower limits of the range of losses associated with defense → collapse.

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SUMMARY

Daily losses and daily net losses (casualties minus replacements) in enlisted men and in officers were computed in terms of percents on the basis of the men and officers present each morning, the data being taken from the corrected morning reports of the component elements of each infantry battalion studied. These data were analyzed in relation to each category of breakpoint and the following manipulations of the data were tried in order to discover which might be most significant:

Casualties and net casualties, in percent, on the day of breakpoint;

Cumulative casualties and cumulative net casualties, in percent, for the day of breakpoint plus the two days preceding;

Cumulative casualties and cumulative net casualties, in percent, from the start of the engagement to the breakpoint.

This approach was expected to provide evidence as to which combination of losses and of net losses were most significantly associated with a given category of breakpoint. The approach was deficient in that the cumulative casualties, in percent, were calculated without regard to the variable, time from start of engagement to breakpoint. It was felt that, in addition to numerical losses, certain psychological factors were also operative, closely related to losses and also to length of time in combat, factors termed "attrition." It was evident, too, that cumulative net losses, which take into account the arrival of replacements, are also a function of time.

Cumulative casualties and cumulative net casualties, in percent, were, therefore, computed for breakpoints in each category, occurring in 2 to 4 days from start of engagement, 6 to 11 days, and 13 to 22 days, time divisions into which the data conveniently fell.

Extrapolation from conventional warfare to atomic warfare was attempted to determine what loss percentages received in a brief span of time might destroy an infantry battalion's effectiveness. The data permitted no more than tentative suggestions.

Eleven other variables which may have had some influence on the ability or inability of units to fulfill their missions were discussed in relation to the engagements studied:

Condition of troops at beginning of engagement
Unusual environmental stresses
The imperative of the assigned mission
Morale
Leadership
Tactical plan
Reconnaissance
Enemy opposition
Fire support and reinforcement
Logistical support
Communications

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CONCLUSIONS

1. The statement that a unit can be considered no longer combat effective when it has suffered a specific casualty percentage is a gross oversimplification not supported by combat data.

2. Casualties can be taken as a significant measure of loss of combat effectiveness only if the proper defining and limiting factors are specified:

a. The type and size of unit must be stated.

b. Ranges of loss percentages rather than averages should be used because of the wide variations in data.

c. The nature of the unit's mission must be specified. Widely differing ranges of loss percentages are associated with a breakpoint from attack to defense and a breakpoint from defense to withdrawal or collapse.

d. The time basis on which loss percentages are figured must be specified—cumulative, on day of breakpoint, or whatever.

3. The most meaningful approach to the analysis of an infantry battalion's loss of combat effectiveness in conventional warfare proved to be in terms of duration of time from the start of engagement to breakpoint, considering not only loss percentages but also replacements and the increasing magnitude of attrition factors. No brief categorical statements of these findings can be made.*

4. As a measure of effectiveness of atomic attack on an infantry battalion, extrapolation from casualty data in conventional warfare suggests losses of 4 to 23 percent in enlisted men, provided the unit is fresh and at full strength and the resultant temporary demoralization can be swiftly exploited by conventional means. Complete demoralization of such a unit, by atomic attack alone, may be achieved by the infliction of losses in the range of 40 to 70 percent.

5. Proportionately higher losses in officers than in enlisted men are not characteristic of breakpoints in infantry battalions.

6. The very wide individual differences in the ability of infantry battalions to carry out a given mission cannot be accounted for in terms of casualties alone, no matter how the data are presented. Of the other interacting variables it is believed that failures and breakdowns in leadership, fire support and reinforcement, and communications are the most frequent and powerful influences.

* See more detailed Conclusions at end of this memorandum.

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CASUALTIES AS A MEASURE OF THE LOSS OF COMBAT
EFFECTIVENESS OF AN INFANTRY BATTALION

SELECTION OF DEFINITIONS AND DATA

PURPOSE OF STUDY

The statement is frequently made that a unit can be considered as no longer combat effective when it has suffered N percent casualties. N has been variously defined, but estimates of Army officers usually fall in the range of 20 to 30 percent, and 30 percent has been given wide credence. A magic number such as this has obvious attractions. It can serve as a basis for decision by commanders in the field; it can be used as a measure of the radius of effectiveness of an atomic weapon on a troop target; it can serve as a criterion of win-or-lose in war-gaming.

Although the statement seems to have been based solely on the intuitive judgment of experienced officers, it is susceptible to analysis from actual wartime experiences, since unit strengths and losses are recorded in numerical terms. In fact, of all possibly significant factors affecting a unit's combat effectiveness, casualties* alone can be directly quantified. Casualties are, moreover, a factor always present in battle, and their magnitude may be assumed to reflect to some degree the magnitude of other less tangible factors. A careful analysis of the validity of casualty percentages as a significant measure seemed, therefore, the logical first approach to the determination of the loss of combat effectiveness of a unit.

It is believed that the statement as it stands is a gross oversimplification. This study is an effort to point out some of the problems involved in arriving at the necessary definitions and qualifications, in discovering the most meaningful treatment of casualty data, and in determining the relative significance of other factors which influence a unit's combat effectiveness.

BASIC PREMISES AND PROBLEMS

Starting with the basic assumption that casualties are indeed a significant measure, the following premises and derivative problems were formulated. These will be discussed in detail later in the study.

(1) The same significant casualty rates will not apply to all units but will vary (a) with the size of the unit (army, division, battalion), and (b) with the type of unit (infantry, armor, artillery, etc.).† As a first approach, this study has been confined to infantry battalions in the ETO in World War II.

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* The word "casualty" is used throughout to mean any degree or form of incapacitation, whatever the cause, which removes a man from action.

† For example, see Appendix A.

(2) In military operations a unit is considered to have lost its combat effectiveness when it is unable to carry out its mission. How is the onset of this inability—hereafter termed the "breakpoint"—to be recognized or defined?

(3) The mission of a unit may be, broadly stated, to attack or to defend It first appeared that two significant types of breakpoints should be considered: (a) when a unit is no longer able to attack but is still capable of defending; and (b) when a unit can no longer defend—that is, it has completely collapsed as a fighting organization. It was thought that the second breakpoint would be associated with a much higher casualty percentage than would the first.

(4) "N percent casualties" is meaningless as it stands; careful definition is obviously necessary. If the measure is to be used to evaluate the results of atomic attack, it, of course, applies to immediate casualties. But the estimates of the value of N made by Army officers are drawn from conventional warfare in which engagements usually continue a week or more. Do the 20 to 30 percent losses estimated to be crucial represent the cumulative casualties from the beginning of the engagement to the breakpoint, or perhaps the cumulative casualties for the few days preceding the breakpoint, or the casualties on the day of the breakpoint? Furthermore, should reinforcements be subtracted from casualties and the net losses taken as the measure? What is the significance of time from start of engagement to breakpoint? To answer such questions several ways of handling casualty data have been explored.

(5) The significant casualty figures have been taken to be the fairly complete and accurate data developed from the unit morning reports and subsequent corrections. But these actual losses are known to the commanding officers in retrospect only. Should the often erroneous estimates of casualties made during combat perhaps be taken as the significant measure?

(6) Factors other than personnel losses also contribute to destroy a unit's combat effectiveness. An attempt has been made to determine the most important of these and to give some indication of their significance in the engagements studied.

POPULATION OF THE SAMPLE

Forty-four US infantry battalions involved in seven engagements in ETO in World War II were studied (see Appendix B). An engagement* was taken to be the period of combat during which the divisions, of which these battalions were components, fought to carry out a specific mission, the termination being marked by the beginning of a period of relative inactivity following definite success or failure in achieving the mission.

No effort was made to analyze enemy strengths or tactics in these engagements, but World War II was chosen because German equipment and methods accord more closely with US than do Japanese, North Korean, or Chinese. Situations were selected in which the enemy was able to mount a strong attack or to offer effective resistance. The engagements, therefore, represent conflict

*Regimental and division after-action reports and histories customarily use the word "battle" to describe such actions but, since this term has been employed in ORO-T-274, "Tactical Organization for Atomic Warfare," by James W. Johnson, May 1954, SECRET, to mean only the most intensive kind of struggle, of a few days' duration, a different word was used to avoid ambiguity.

between roughly comparable opponents. The ETO was chosen as introducing fewer extremes in climate and terrain than North Africa, or Italy, or the Pacific Islands, and also because this region may well be the arena in which World War III is fought.

The infantry battalion was picked as the unit for study for the following reasons:

(1) The infantry battalion is the basic tactical unit in conventional warfare.[*]

(2) Since plans for atomic warfare envisage the battalion or some reinforced version as the principal combat unit, data relating to it have special pertinence for future operations.

(3) In conventional warfare the infantry battalion is the unit customarily suffering the highest rate of casualties; that is, most of the casualties within an army or a division occur in the infantry battalions (see Appendix A). If casualty rate is in fact a significant measure of unit effectiveness, this should be most readily detected where casualties are high.

(4) The infantry battalion is not so seriously affected by certain variables which may be quite as significant as casualties in the experience of other types of battalions, namely, losses in materiel or fear of such losses. The low vulnerability of hand weapons makes the firepower and the manpower of an infantry battalion virtually synonymous.[†] The effectiveness of a tank battalion, however, depends as much on the operability of its tanks as on adequate crews to man them, and an artillery battalion may have to change its mission, not because of actual losses of materiel but because enemy counterbattery fire threatens to produce such losses and the battery must shift its position to safeguard its weapons.

(5) Some infantry battalion experiences may approximate the scale of losses to be expected from atomic attack and may afford useful bases for extrapolation to atomic warfare.

DETERMINATION OF BREAKPOINT

The following definitions were developed out of many discussions. A unit is considered to have lost its combat effectiveness when it is unable to carry out its mission. The onset of this inability constitutes a breakpoint. A unit's mission is the objective assigned in the current operations order or any other instructional directive, written or verbal. The objective may be, for example, to attack in order to take certain positions, or to defend certain positions.

How does one determine when a unit is unable to carry out its mission? The obvious indication is a change in operations directive: the unit is ordered to stop short of its original goal, to hold instead of attack, to withdraw instead of hold. But one or more extraneous elements may cause the issue of such orders:

(1) Some other unit taking part in the operation may have lost its combat effectiveness, and its predicament may force changes in the tactical plan. For

[*] FM 100-5, "Field Service Regulations, Operations", p 3.

[†] The records studied yielded no evidence that weapon losses, even in the weapons companies, contribute significantly to breakpoints. Either the losses were light or very rapidly replaced.

example, the inability of one infantry battalion to take a hill may require that the two adjoining battalions be stopped to prevent exposing their flanks by advancing beyond it.

(2) A unit may have been assigned an objective on the basis of a G-2 estimate of enemy weakness which, as the action proceeds, proves to have been over-optimistic. The operations plan may, therefore, be revised before the unit has carried out its orders to the point of losing its combat effectiveness.

(3) The commanding officer, for reasons quite apart from the tactical situation, may change his operations plan. For instance, General Ridgway in May 1961 was obliged to cancel his plans for a major offensive north of the 38th parallel in Korea in obedience to top level orders dictated by political considerations.

(4) Even if the supposed combat effectiveness of the unit is the determining factor in the issuance of a revised operations order, a serious difficulty in evaluating the situation remains. The commanding officer's decision is necessarily made on the bases of the information available to him plus his estimate of his unit's capacities. Either or both of these bases may be faulty. The order may belatedly recognize a collapse which has in fact occurred hours earlier, or a commanding officer may withdraw a unit which could hold for a much longer time.

It was usually not hard to discover when changes in orders resulted from conditions such as the first three listed above, but it proved extremely difficult to distinguish between revised orders based on a correct appraisal of the unit's combat effectiveness and those issued in error. It was concluded that the formal order for a change in mission cannot be taken as a definitive indication of the breakpoint of the unit. It seemed necessary to go one step farther and search the records to learn what a given battalion did, regardless of   visions in formal orders.

Even on this basis, it proved very difficult to choose br   . ints, because unit records are neither detailed nor dependable. Infantry   ons do not usually have individual records. Regimental historier   anti   ction reports do not consistently give detailed accounts of the experiences o   air component battalions. There is, moreover, always a tendency to slide ov   episodes which may show the unit in a bad light. Regimental journals are ofte   complete for periods of active combat, and are difficult to interpret because   s are designated by code names for which a key is usually not availible.   combat interviews with regimental, battalion, and company officers often rel   incidents of panic and other enlightening details but contain many identifiab   errors in date and even in unit involved, and must, therefore, be somewh t suspect throughout. Most of the interviews, furthermore, took place two to six weeks after the engagement, so that lapses in memory are added to the participant's original confusion and failure to grasp a complex situation at the time it occurred. The selection of a breakpoint and the category within which it falls depends, then, on the judgment of the analyst, based on a synthesis of scanty and sometimes contradictory accounts.

CATEGORIES OF BREAKPOINTS SELECTED

In the engagements studied the following categories of breakpoint were finally selected:

Category of Breakpoint	No. Analyzed
I. Attack → rapid reorganization → attack	9
II. Attack → defense (no longer able to attack without a few days for recuperation and reinforcement)	21
III. Defense → withdrawal by order to secondary line	13
IV. Defense → collapse	5

Disorganization and panic were taken as unquestionable evidence of loss of combat effectiveness. It appeared, however, that there were distinct degrees of magnitude in these experiences. In addition to the expected breakpoints at attack → defense and defense → collapse, a further category, I, seemed to be indicated to include situations in which an attacking battalion was "pinned down" or forced to withdraw in partial disorder but was able to reorganize in 4 to 24 hours and continue attacking successfully.

Category II includes (a) situations in which an attacking battalion was ordered into the defensive after severe fighting or temporary panic; (b) situations in which a battalion, after attacking successfully, failed to gain ground although still attempting to advance and was finally ordered into defense, the breakpoint being taken as occurring at the end of successful advance. In other words, the evident inability of the unit to fulfill its mission was used as the criterion for the breakpoint whether orders did or did not recognize its inability. Battalions after experiencing such a breakpoint might be able to recuperate in a few days to the point of renewing successful attack or might be able to continue for some time in defense.

The sample of breakpoints coming under category IV, defense → collapse, proved to be very small (5) and unduly weighted in that four of the examples came from the same engagement. It was, therefore, discarded as probably not representative of the universe of category IV breakpoints,* and another category (III) was added: situations in which battalions on the defense were ordered withdrawn to a quieter sector. Because only those instances were included in which the withdrawal orders appeared to have been dictated by the

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*It had been expected that breakpoints in this category would be associated with very high losses. Such did not prove to be the case. In whatever way the data were approached, most of the casualty averages were only slightly higher than those associated with category II (attack → defense), although the spread in data was wider. It is believed that factors other than casualties, such as bad weather, difficult terrain, and heavy enemy artillery fire undoubtedly played major roles in bringing about collapse in the four units taking part in the same engagement. Furthermore, the casualty figures for the four units are themselves in question: came, as the situation deteriorated, many of the men developed severe cases of trench foot and combat exhaustion, but were not evacuated, as they would have been in a less desperate situation, and did not appear in the casualty records until they had made their way to the rear after their units had collapsed

condition of the unit itself, it is believed that casualty levels for this category can be regarded as but slightly lower than those associated with defense + collapse.

In both categories II and III, "defense" represents an active situation in which the enemy is attacking aggressively.

In some cases a single battalion in the course of the same engagement experienced more than one of these types of breakpoint. On the other hand, 13 of the 44 battalions studied appeared to have experienced no breakpoint, although three of these were borderline cases in which a breakpoint was suspected but could not be confirmed from scanty records. Of the remainder, one, with cumulative losses of 25 percent for enlisted men, 20.5 percent for officers, and cumulative net losses of 18 percent and 13.5 percent at the end of the engagement, successfully beat off a German counterattack; the other nine were in reserve, attached to other units in quiet sectors, or encountered so little enemy opposition that the cumulative losses of each for the entire engagement did not exceed 13.5 percent for either enlisted men or officers.

DATA USED FOR COMPUTING CASUALTIES

Data were taken from the daily morning reports of battalion headquarters, headquarters company, the three infantry companies, and the heavy weapons company, in which are recorded casualties, and replacements and men returned from hospital or detachment to another unit. Corrections appearing in the two to three weeks subsequent to the engagement* were counted as of the day the casualties occurred and replacements were assigned. It is believed that the figures from the corrected morning reports represent with fair accuracy the casualties and replacements for each day as known in retrospect.

The fact must be faced, however, that command decisions in combat are not based on these data since they are not completely known to anyone while the fight is on. What casualty data were available during the engagements cannot be learned from uncorrected morning reports, because there is no way of telling whether these indicate the information in hand or simply the fact that the clerks had fallen behind in their paper work.† The only sources are chance entries in unit journals and messages, scattered notes, or, less dependably, combat interviews days to weeks later. Enough instances survive to make clear the wide divergencies from the formal records during periods of heavy losses.

In some cases these divergencies may simply reflect the inadequacy of available information. A battalion officer's casualty report to regimental headquarters may prove later to have been made on the basis of unfounded rumor. For example, all communication between battalion headquarters and Company B has been lost. A straggler appears and states that Company B was surrounded and only he escaped. A day later all but 25 men of Company B

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*A few corrections may have been made even later. These are not included in the data used in this study, but the number for any one battalion is believed to be negligible.

†In some of the reports of the 513th Regiment, 17th Airborne Division, for example, no casualties were listed during an entire week although subsequent corrections showed as many as 100 casualties in one day in one company.

are present and well. Perhaps the straggler had been offering an excuse for his own presence at the rear, or the enemy may have been threatening infiltration at the rear of Company B but was subsequently driven out, or the whole company may in fact have been cut off but held out until contact was restored by a rescue party. Whatever the actual facts, battalion headquarters must act on what it believes them to be at the time the message is received. In the meantime the report is spreading among the men. Perhaps the supposed loss of a company is the shove needed to start a general melting away to the rear. Here then is a breakpoint caused not by actual but by supposed losses.

Analysis of 14 instances, in which supposed numbers of enlisted men present in an entire battalion or company were reported in combat interviews or unit journals, showed these estimates of strength to be less than two-thirds the actual strength recorded in corrected battalion morning reports.

In other examples of strength estimates given in unit records or interviews, one may suspect that the data refer to the believed effective fighting strength, that is, the number of men in the front lines, not counting cooks, clerks, headquarters staff, etc. No such distinction is, of course, made in the morning reports, nor, presumably, is any such distinction intended when N percent casualties are cited as marking the destruction of the combat effectiveness of a unit. Nevertheless, it may be suspected that a battalion officer tends to estimate the effectiveness of his unit in terms of losses in the men who customarily do the actual fighting.* To be sure, in some of the situations studied, drivers, cooks, and battalion headquarters company fought the enemy with their rifles, but only when front-line losses made this necessary, and when the unit had already passed the breakpoint from attack to defense. Except in such emergencies, or in the case of a lucky hit on the battalion CP, casualties among such troops are light. When the cumulative percentage of losses in a battalion runs as high as 50 percent, it seems likely that the experienced fighting force has been virtually wiped out, and perhaps the remaining 50 percent should be subject to some sort of degradation factor in evaluating the unit's effective strength.

The wide range of casualty percentages found in the corrected morning reports in connection with a given category of breakpoint may, then, result, at least in part, from the inclusion of situations in which a breakpoint was caused by supposed losses which were much higher than actual casualties, or by an extremely high ratio of losses in riflemen to losses in other battalion troops. Only by the merest chance, however, can such facts be detected in the records, so the frequency of occurrence and the degree of variance between reported data and data on which decisions were based cannot be estimated with any certainty.

All this, of course, casts serious doubt on the value of the post facto casualty records as a base for establishing the significant range of casualties associated with a breakpoint. The argument may be advanced, however, that if a breakpoint is determined by the actual inability of the unit to continue its mission rather than by the judgment of an officer, the corrected casualty reports do give the true measure. Because the whereabouts and condition of some of

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*In World War II, Russian unit strength reports were often made in terms of "personnel directly engaged in fighting," including, in regimental reports, front-line riflemen and much of the men and gunners serving mortars and regimental artillery. German units also used a similar basis in reporting combat strength (kampf stärke) or trench strength (graben stärke).

its men are not known to company or battalion officers at a given moment in battle doe~ not necessarily mean that these men have ceased to take an active part in the fighting. This more or less temporary loss of communications within the unit may make little difference so far as the impact of the unit on the enemy is concerned.
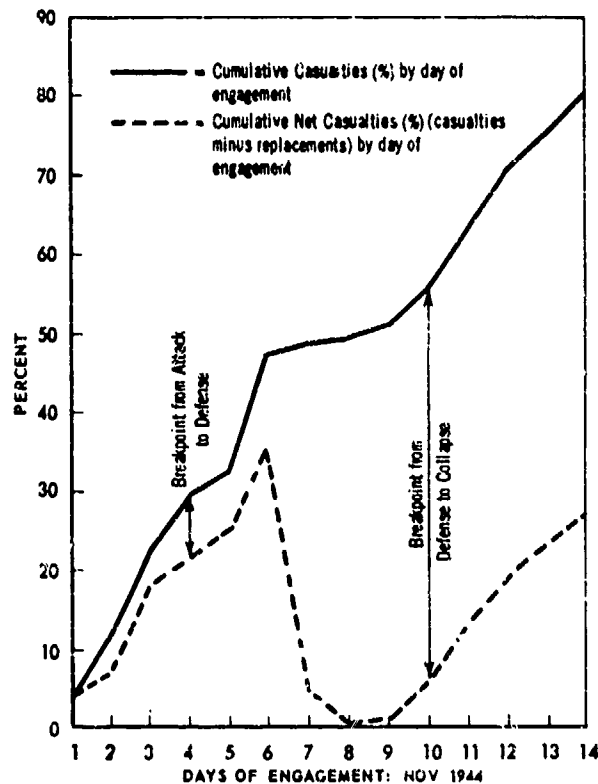
Fig. 1—Losses of an Infantry Battalion in an Engagement
(28 Div, 109th Regt, 1st Bn)

If due recognition is given to the uncertainties involved, it is believed that useful conclusions can be reached from the data from corrected morning reports.

The raw data collected include a breakdown between battle and nonbattle casualties but for this study both types have been lumped together.* No effort was made to distinguish between the types of battle casualties—KIA, MIA, SWA, LWA—because the important factor for this study was the number of officers

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*It may be noted that units vary in the care with which they disting. ~ u ~ ~ ween battle and nonbattle esualtir of the criteria which they use, so that the accuracy of a breakdown on this basis would have to be regarded with reserve.

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and of men not available for action on a given day rather than what had befallen them or how soon they might be expected to return. Throughout the study data relating to officers and to enlisted men* were compiled separately to discover whether the rates were similar or if disproportionate percentages of officer casualties were perhaps associated with breakpoints.

BASE FOR CALCULATING LOSS PERCENTAGES

Two series of daily loss percentages were computed: (a) casualties alone; and (b) casualties minus replacements, i.e., the net loss per day.

Since the 30 battalions† experiencing breakpoints were, at the beginning of the engagements studied, at least 90 percent of authorized strength,‡ the base for calculation of percents was taken to be the number of men and of officers present on the morning the engagement began. Casualties and replacements occurring on that day were respectively subtracted from and added to the base to give the number of men and of officers who were present on the following morning. This figure in turn formed the base for calculating (a) the percentage of men and of officers lost on that day, and (b) the percentage of net losses in men and in officers; and so on throughout the engagement. Figure 1 is a sample graph of the cumulative casualties and cumulative net casualties in percent by day of engagement for one battalion.

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*Warrant officers were counted as enlisted men.

†One battalion which was only 75 percent of authorized strength and whose experience was very atypical was not included in these calculations, but is discussed later.

‡The Office of Military History gives the authorized strength of an infantry battalion during the period 15 July 1943 to 1 June 1945 as 35 officers, 836 men. Thirteen battalions studied were slightly overstrength in officers, eight slightly overstrength in men at the start of the engagements studied.

ANALYSES OF DATA WITH RESPECT TO BREAKPOINTS

As has been said, N percent casualties us a measure of combat effective-ness requires definition. In the attempt to find that which would be most mean-ingful, different analyses of the data were developed. It must be borne in mind throughout that, because of the wide variations inherent in casualty data as well as the wide variations resulting from small samples, averages (means) signify little. They are used herein merely as convenient indicators of relative magni-tudes. Ranges based on one standard deviation from the mean of the sample* give a more meaningful picture of what may be expected in actual combat experience and are used throughout this study.†

ATTRITION FACTORS

Fundamental to the whole problem of the relation of casualties to break-points are the following considerations: Does a unit lose its combat effective-ness because it lacks a certain requisite number of bodies, each type of break-point being caused by a given depletion in numerical strength? If this be true, the arrival of sufficient replacements should restore the unit's ability to carry out its mission. But intuition suggests that, in addition to numerical strength, certain psychological factors closely related to losses, replacements, and length of time in combat must also be recognized—factors which are here des-cribed by the word <u>attrition</u>. Included may be growing awareness throughout the unit that casualties have been heavy, accumulating memories of casualties witnessed by individual members of the unit, increasing apprehension among survivors as to their own fate, and accumulation of physical weariness and strain. One may also ask whether replacements represent a reinforcement in mental attitude, or whether they are instead very rapidly infected by the pre-vailing atmosphere of the unit, or if they in turn tend to degrade the effective-ness of the unit by their own inexperience and confusion.

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*In this study, calculated at $n-1$ degrees of freedom.

†Tables 1 and 2 include the ranges within which the mean of the universe mn, be expected to fall at !! 95 percent confidence level, $n-1$ degrees of freedom.

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CASUALTY PERCENTAGES ANALYZED
WITH RESPECT TO TIME BEFORE BREAKPOINT

Opinions vary as to what time aspect of casualties may be most directly
contributive to a breakpoint. Three approaches were computed for each break-
point (see Table 1 and Appendices C and D):

(1) Losses and net losses, in percent, for the day of breakpoint.

(2) Cumulative losses and cumulative net losses, in percent, for the two
days preceding plus the day of breakpoint.

(3) Cumulative losses and cumulative net losses, in percent, from the
beginning of the engagement to the breakpoint.

The first approach was dictated by the school of thought which contends
that the present experience is the major demoralizing influence. The second
was suggested by the idea that men's memories encompass not only the pres-
ent but also the experiences of the very immediate past; it was thought that
breakpoints might be characterized by very heavy and unreplaced losses just
previous to the actual day of breakpoint. The third represents the battle ex-
perience as entirely cumulative and provides as well the best measure of
actual physical unit strength.

The average cumulative losses, in percent, for the three-day time span of
casualties (the two days preceding breakpoint plus the day of breakpoint) were
inspected (see Table 1) to see whether high losses during this period were
actually associated with breakpoints. It appeared that the main factor in these
averages was the loss on the day of breakpoint. In category I (attack → rapid
reorganization → attack) the average loss on the day of breakpoint represented
about three-fourths of the average loss in enlisted men in the three-day period;
in II (attack → defense) and III (defense → withdrawn) about one-half.

This ratio was even more striking when net losses were considered. Few
replacements were received on the day of breakpoint, but in some cases sub-
stantial numbers had arrived during the preceding two days. Average losses
on the day of breakpoint, therefore, constituted an even larger proportion of
the average cumulative net losses in the three-day period: 86.5 percent of the
three-day average for enlisted men in category I, about two-thirds of the three-
day average for enlisted men in categories II and III

It was concluded, therefore, that losses on the day of breakpoint in all
three categories of breakpoint are more significant than the three-day total,
whether replacements are considered or not.

Average cumulative casualties, in percent, from start of engagement to
breakpoint give some indication of the relative magnitude of losses associated
with each category of breakpoint. The averages for categories I and II are suf-
ficiently similar—I, enlisted men 24.6 percent, officers 21.5 percent; II, enlisted
men 27.6 percent, officers 26 percent—to suggest that they represent closely
comparable situations, and that some factor not measured by cumulative losses
intervened to prevent the units in category II from recuperating quickly. A look
at the average losses, in percent, on the day of breakpoint (see Table 1) suggests
a possible explanation. They are conspicuously higher for category I than for
II. The much higher average cumulative net casualties, in percent, in category
I also, of course, reflect the high net losses on the day of breakpoint. The guess
may be hazarded that high losses received within a few hours, as was the case

TABLE 1

CASUALTIES BY TIME BEFORE BREAKPOINTS

Category of Breakpoint	Size of Sample	Cumulative Casualties, %						Cumulative Net Casualties, % (Casualties minus replacements)					
		Enlisted Men			Officers			Enlisted Men			Officers		
		Range, 95%	Mean, %	σ	Range, 95%	Mean, %	σ	Range, 95%	Mean, %	σ	Range, 95%	Mean, %	σ
Casualties on Day of Breakpoint													
I	9	7.23–23.45	15.34	10.35	5.22–20.56	11.89	11.06	7.10–21.44	14.27	9.14	2.16–19.66	10.91	11.18
II	21	3.98–8.60	6.29	5.00	3.43–7.29	5.36	4.15	2.43–7.13	4.78	5.09	2.01–6.13	4.02	4.37
III	13	3.41–22.29	12.85	15.45	0.33–18.01	9.17	14.46	1.80–20.70	11.00	15.98	−6.98–17.14	5.33	19.90
Cases true for 2 Days Preceding, plus Day of Breakpoint													
I	9	12.21–26.63	19.42	9.21	7.80–24.58	16.19	10.72	9.26–23.74	16.50	6.23	−5.17–21.15	7.99	16.70
II	21	10.36–16.68	13.52	6.83	7.64–17.42	12.53	10.34	3.88–10.58	7.23	7.52	0.28–13.51	7.66	14.65
III	13	15.87–35.63	25.75	16.16	15.25–35.35	25.30	16.46	4.24–30.64	17.44	21.63	6.83–30.45	18.64	19.34
Casualties from Start of Engagement to Breakpoint													
I	9	15.01–34.61	24.81	12.51	11.09–31.95	21.52	13.31	8.55–25.05	16.80	10.54	−5.00–22.44	8.72	17.53
II	21	18.29–37.00	27.64	20.19	15.91–36.09	26.00	21.82	4.93–13.79	9.36	9.57	−1.09–16.81	7.86	19.34
III	13	42.09–62.55	52.32	16.73	36.06–57.00	46.38	16.90	23.48–53.18	38.33	24.30	17.61–45.77	31.69	23.04

[a] Range of mean at 95 percent confidence level, n-1 degrees of freedom.

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in situations in category I (attack → rapid reorganization → attack), are more easily absorbed than a similar loss percentage spread over several days, as in category II (attack → defense).

As had been expected, the average cumulative casualties, in percent, from start of engagement to breakpoint were much higher for category III (defense → withdrawn by order) than for categories I and II, in fact about twice as high,
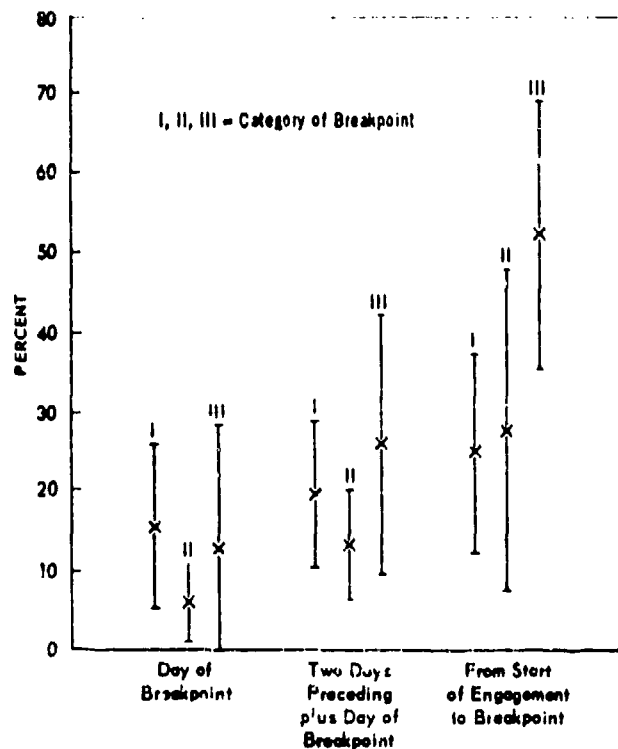
Fig. 2—Cumulative Casualties (%) in Enlisted Men by Time before Breakpoints

Ⅹ indicates one standard deviation from the mean (X) of the sample

the average for enlisted men being 52.3 percent, the average for officers 46.4 percent. It should be noted that even the lower limit of the 95 percent confidence level range of mean cumulative losses, in percent, lies above the higher range in the other two categories (see Table 1), and a similar relation appears between cumulative net casualties, in percent, in the three categories of breakpoint. The range of losses, in percent, on the day of breakpoint in category III is also markedly higher than for category II; in fact it resembles that for category I. It seems clear, then, that category III (defense → withdrawn by order) represents situations in which high losses occurred throughout the period of the engagement up to and including the day of breakpoint.

The appearance of average cumulative casualties within the range of 20 to 30 percent for categories I and II suggests that here may be the basis for the original statement that loss percentages of this magnitude destroy the ability of a unit to carry out its mission. It is evident, however, that the statement applies only to a certain type of mission and needs to be carefully qualified. The following definitions appear more accurately to describe the evidence from combat data:

(1) Cumulative losses of enlisted men in the range of 7 to 48 percent (average 26 percent) are associated with the inability of an <u>attacking</u> infantry battalion to fulfill its mission. The unit may be able to continue the attack after a few hours if more than half the losses are incurred in a short time (no longer than 24 hours); otherwise it must revert to defense.

(2) Cumulative losses of enlisted men in the range of 37 to 69 percent (average 52 percent) are associated with the withdrawal of an infantry battalion <u>in defense</u> to prevent its collapse which may be presumed to be imminent.

The use of cumulative casualties, in percent, is not, however, the most meaningful approach to the data because the varying duration of time from start of engagement to breakpoint has not been considered. In the battalion experiences included in category I, time to breakpoint ranged from 2 to 11 days, in category II from 2 to 22 days, in category III from 6 to 17 days.

CASUALTY PERCENTAGES ANALYZED WITH RESPECT
TO DURATION OF ENGAGEMENT PRIOR TO BREAKPOINT

As has been suggested earlier, time is an essential element in estimating the factor of attrition. It is also an essential element in net losses; that is, the arrival of replacements is a function of time. While it may well be that replacements do not fully take the place of the experienced men who have been lost, it would probably be agreed that they do have some positive value to the unit and should not be ignored. Cumulative losses alone, therefore, are not likely to be the best measure of a unit's effectiveness unless it can be shown that such percentages bear a fixed relation to cumulative net losses; but it is not apparent that this is the case. The World War II infantry divisions, of which the battalions studied were a part, were accustomed to feed replacements into their component units during active combat. If the period between start of engagement and breakpoint was long enough to cover the necessary lag between reported losses and arrival of replacements, one would expect a rather close approximation of losses and replacements, and net losses would approach zero, provided, of course, that the system of feed-in was not upset by such factors as strong enemy opposition, breaks in communications, or bad weather. Table 2 indicates that at least two weeks were required to bring an infantry battalion close to its original numerical strength. The ratio of average cumulative casualties, in percent, to average cumulative net casualties, in percent, increases with the length of the engagement in roughly the following proportions: 1:1 on the first day, 2:1 in the second week; 5:1 by the third week (see Table 2).

The reduction of cumulative casualties from start of engagement to breakpoint to average loss percentage per day produced a wide spread of data and no illumination.

TABLE 2

CASUALTIES BY BREAKPOINT CATEGORY AND DURATION OF ENGAGEMENT

Category of Breakpoint	Size of Sample	Cumulative Casualties, %						Cumulative Net Casualties, % (Casualties minus replacements)					
		Enlisted Men			Officers			Enlisted Men			Officers		
		Range, %[a]	Mean, %	σ	Range, %[a]	Mean, %	σ	Range, %[a]	Mean, %	σ	Range, %[a]	Mean, %	σ
2 to 4 Days													
I	6	11.89–34.41	23.15	10.61	7.00–32.27	18.57	12.75	6.43–34.51	20.47	13.24	3.93–32.53	18.23	13.48
II	7	6.40–20.64	13.52	9.08	8.13–16.63	12.38	5.42	5.47–16.99	11.23	7.34	5.10–12.90	8.95	4.91
III	0	–	–	–	–	–	–	–	–	–	–	–	–
6 to 11 Days													
I	3	20.00–54.95	28.10	14.82	1.40–53.36	27.43	10.44	0.60–18.40	9.56	3.58	–49.92–27.04	–11.44	15.40
II	8	21.69–38.69	30.19	10.03	13.77–41.51	26.64	16.35	7.39–22.41	14.90	8.85	–10.01–36.31	13.15	27.30
III	9	45.40–68.00	56.70	14.43	32.29–59.65	45.07	17.45	33.02–66.48	49.75	21.37	27.68–56.72	42.20	18.53
13 to 22													
I	0	–	–	–	–	–	–	–	–	–	–	–	–
II	4	29.02–88.62	54.32	21.44	7.29–99.25	53.27	28.75	–15.89–27.63	5.87	13.60	–38.67–26.35	–6.16	29.32
III	6	11.36–73.44	42.40	19.50	16.00–74.01	45.05	18.10	6.04–19.16	12.60	4.11	2.79–13.15	7.97	3.24

[a] Range of mean at 95 percent confidence level, n – 1 degrees of freedom.

A rank-order test was made of the battalion experiences included in each category of breakpoint to discover if correlation was indicated between duration of time from the start of the engagement to the breakpoint and cumulative casualties, in percent, and cumulative net casualties, in percent, for this period. If some attrition factor relative to time in combat is significantly present, one would expect a rank-order test to show clear evidence of negative correlation; that is, high cumulative casualty percentages at a breakpoint would be associated with a short period of combat and lower cumulative percentages with a longer period.

In category I there was no definite evidence of any correlation, the correlation coefficient being 0.15 for enlisted men and also for officers. In category III some negative correlation was indicated for enlisted men, -0.40, and none for officers, -0.05. In category II, however, there was strong evidence of positive correlation: 0.81 for enlisted men, 0.75 for officers. In other words, in situations in which units "broke" from attack to defense, some battalions went into defense following very low cumulative casualties received in a few days while others were able to continue attacking for much longer periods of time until they had incurred a much higher cumulative total of losses. The test when applied to cumulative net casualties gave no definite correlations, positive or negative.

These results pointed to the need for a closer analysis of the data in relation to time. The data divided conveniently into breakpoints occurring in 2 to 4 days, 6 to 11 days, and 16 to 22 days, that is, roughly into one-, two-, and three-week periods from the start of the engagements.

As can be seen in Table 2, two-thirds of the breakpoints in the sample in category I (attack → rapid reorganization → attack) occurred in the first time period, and none occurred in the third. In the 2- to 4-day sample almost all of each battalion's losses occurred on the day of breakpoint. Virtually no replacements were received.

Cumulative losses in enlisted men by individual battalions in first time period (%)	Losses in enlisted men by individual battalions on day of breakpoint (%)
9.73	6.62
11.59	11.17
21.13	20.60
31.06	30.48
32.50	32.13
32.90	14.51

One may surmise from Table 2 that an infantry battalion during the first few days of battle can recuperate quickly from unreplaced losses in enlisted men ranging from 13 to 34 percent (mean 23 percent), in officers ranging from 6 to 31 percent (mean 18.6 percent), if these losses are incurred within a few hours.

In the case of battalions experiencing category I breakpoints during the second week of an engagement, average cumulative casualties, in percent, are about one-fifth higher but enough replacements have been received to bring the battalion strengths in enlisted men to a considerably higher level than that asso-

ciated with breakpoints in the 2- to 4-day period. Losses on the day of break-
point, however constitute a much smaller proportion of the cumulative total
and are in themselves lower than those from which battalions recuperated
quickly in the first week. In other words, battalions with a higner numerical
strength but a longer period in combat and higher total casualties were able to
recuperate quickly only if the casualties on the day of breakpoint were light.
In fact it is possible that the reason they were able to recuperate at all was
because their original strength in officers had more than been replaced (average
cumulative net casualties for officers, -11 percent).

By the third week it would appear that the type of rapid reorganization
associated with category I had become impossible.

In category II (attack → defense), the positive correlation between cumula-
tive casualties, in percent, and time-to-breakpoint, suggested by the rank-order
test, is clearly confirmed. The cumulative net percentages for each time period
may, however, offer some explanation of this seeming anomaly. Most of the bat-
talions in the sample broke when the average net losses totalled 11 to 15 percent
for enlisted men, 9 to 13 percent for officers, 43 percent of the sample reaching
this point during the first time period and 39 percent during the second.

The average cumulative casualties at breakpoints in category II during the
first week are about one-third lower than in category I; in these battalions also
very few replacements had been received. In most cases high casualties did not
occur on the day of breakpoint, but the total was spread over the period.

A detailed examination of the records suggests some reasons why a some-
what lower total of casualties incurred over a few days proves more demoraliz-
ing to an infantry battalion than a somewhat higher total received within a few
hours. On a given day, 50 percent or more of the battalion losses are likely to
occur in one infantry company. If this happens early in an engagement when
cumulative losses to date have been light, the other company in the front lines
can continue attacking and the fresh reserve company can be put into action
quickly.

But suppose that, on the first day of an engagement, Company A suffers
25 casualties (3 percent of battalion strength) and Company B loses 8. On the
second day these experiences are reversed. On the third day Company C is
committed, loses 50 men (6 percent of battalion strength but 26 percent of
company strength), and is unable to continue attacking. Companies A and B
have by now cumulative losses of 36 each; Company D, the heavy weapons
company, has lost 5 men, and Battalion Headquarters 2. The cumulative losses
of the battalion for the three-day period are 15 percent. There is no reserve
company to replace C; A and B are too depleted to carry the initiative alone.
The battalion can do no more than reorganize, with full support from the heavy
weapons company, and dig in for defense.

At breakpoints i the 6- to 11-day period, cumulative losses in enlisted men
and cumulative losses in officers in category I are almost identical with those
in category II—averaging 28 to 30 percent, and 27 percent, respectively; and
there is little difference in the spread of data (see Fig. 3). In most cases un-
usually heavy casualties were not incurred on the day of breakpoint. The only
explanation in terms of casualties for the ability of those in category I to reor-
ganize and go on attacking, while those in category II could not, lies in the more
than complete replacement of their losses in officers, noted above, and a some-
what fuller replacement of enlisted men.

A further one-fifth of the sample in category II did not break until the third week By this time, replacement of enlisted men had brought the units almost up to initial strength, and losses in officers had been slightly more than replaced. If numerical strength alone were the measure of effectiveness, these units should have experienced no breakpoint. That they did seems clear indication that some kind of attrition factor was operative, related probably to the
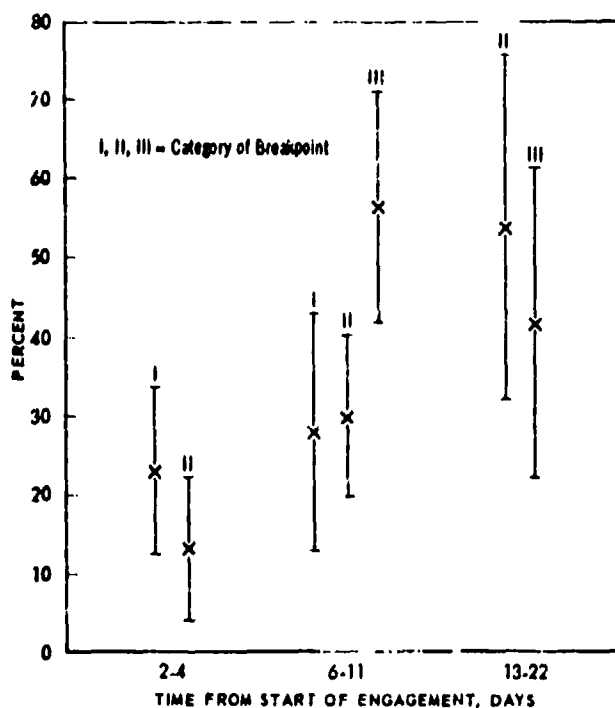
Fig. 3—Cumulative Casualties (%) in Enlisted Men at Breakpoints Occurring at Various Time Intervals from Start of Engagements

⊥ indicates one standard deviation from the mean (X) of the sample

following facts: the cumulative losses averaged more than 50 percent, most of these being "old" men whom the replacements could not really replace. The remaining original members of the unit had been in combat at least 17 days and were battle weary.

About two-thirds of the breakpoints in category III (defense → withdrawn by order) took place in the second time period (6 to 11 days), and are associated not only with high cumulative casualties, in the range of 42 to 71 percent for enlisted men, 29 to 63 percent for officers, but also with very small replacement of losses. This failure to receive substantial replacements during the second week may be evidence of other demoralizing factors, such as breakdown of communications and transport resulting from bad weather and intense enemy

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opposition. Since no examples of this category of breakpoint occurred before the sixth day of engagement, it would seem that the appearance of this type of breakpoint is a function of duration of the engagement, and it may be that if substantial replacements had been received in the second week the necessity for withdrawal would have been deferred.

By the third week, however, replacements could no longer balance the effects of attrition. Battalions which experienced this category of breakpoint in the 13- to 22-day period had received enough replacements to bring them close to their original numerical strength, but this was not sufficient to compensate for the fact that they had received an average of more than 40 percent cumulative casualties* and had been in combat at least 13 days.

SIGNIFICANCE OF OFFICER LOSSES

As Tables 1 and 2 show, in casualties related in any way to breakpoints, average loss percentages in officers were consistently slightly below those in enlisted men. For example, in average cumulative losses, in percent, from start of engagement to breakpoint, the ratio was 0.79:1. In average cumulative losses, in percent, from start to termination of engagement, the difference was less marked—0.92:1.

After reading several hundred combat interviews relating to the engagements analyzed in this study, the expectation had been strong that the casualty percentages for officers, at least on the day of breakpoint or immediately preceding, would be markedly higher than for enlisted men. An explanation for this erroneous impression may lie in the fact that the interviews were mainly with battalion or company officers who naturally reflected their personal concern over the fate of their friends or of their immediate superiors or subordinates on whom they had depended and whose loss had greatly increased their own burdens.

No evidence was found to indicate that casualties among officers had a demoralizing effect out of proportion to their numerical incidence.† On 5 percent (26) of the total battalion days, losses of 10 percent or more in officers exceeded the percentage of losses in enlisted men.‡ The ratio between average loss percentages in officers and in enlisted men on these days was 1.66:1. Breakpoints occurred on but five of these days and then the ratio in losses was only 1.2:1. It would appear that disproportionately high losses in officers on a single day is not a factor of sufficient magnitude to contribute materially to a breakpoint.

As the net cumulative casualties, in percent,§ show, replacement of officers was sometimes accomplished somewhat more quickly and completely than was the replacement of enlisted men. One method of replacement, which was

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*Although one may suspect that the average cumulative casualty percent associated with category III breakpoints in the third week is slightly lower than that in the second week because of the influence of attrition factors, this figure may simply reflect the vagaries of a small sample.

†Indeed the reverse may sometimes be true. In one instance an airstrike hit ~ out on CP. When the news reached the battalion's companies, the men insisted on being allowed to attack to avenge the deed.

‡Losses below 10 percent were considered inconsequential.

§See Tables 1 and 2.

often used but which is not reflected in the numerical data, was to change the assignment of remaining officers and NCO's within the battalion so that the most vital posts were immediately filled. These changes might or might not later be confirmed by battlefield promotions. Alternatively, new officers might be brought in. If these came from infantry battalions within the same division they might at least be acquainted with the general battle situation and with the officers with whom they were to work. But a man entirely unfamiliar with the engagement, the terrain, the unit, and sometimes even with infantry procedure (in cases where an officer was pulled in from a nearby antitank or armored unit) could not by any measure other than numerical be regarded as an actual replacement of an experienced officer.

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CASUALTY PERCENTAGES AS A
MEASURE OF EFFECTIVENESS OF ATOMIC ATTACK

In few of the battalion experiences studied were losses incurred which in magnitude and immediacy are comparable directly with those to be expected from atomic attack on a battalion. Because attrition factors and replacements begin to exert an influence on breakpoints by the second week of an engagement, it seems unsound to attempt extrapolation to atomic attack from such data. The best that can be done is to suggest, from losses incurred by battalions in the opening days of a conventional engagement, casualty levels which may be meaningful in evaluating the effectiveness of atomic attack on an infantry battalion.

The desirable outcome of attack by atomic or conventional means is the complete demoralization of the enemy unit. This did not occur in conventional warfare in breakpoints of the types included in categories I (attack→rapid reorganization→attack) and II (attack→defense) since enemy exploitation was sufficiently slow to enable units to organize their remaining capabilities of effective aggressive action or resistance. If it be assumed that tactics in atomic warfare will be revised to allow very swift exploitation following atomic attack, the level of casualties associated with these types of breakpoints will be adequate to permit the exploiting forces to move in and complete the demoralization of the unit. It will be recalled that the cumulative losses for breakpoints in categories I and II occurring within 3 to 4 days of the beginning of the engagement were found to be in the following ranges: category I, enlisted men 13 to 34 percent, officers 6 to 31 percent; category II, enlisted men 4 to 23 percent, officers 7 to 18 percent.

Most of the losses associated with category I occurred on one day and in that sense are most directly comparable to the circumstances of atomic attack. It will be recalled, however, that most of these casualties occurred within one company, and that battalions broke from attack to defense at somewhat lower cumulative casualty levels when casualties were spread throughout the battalion so that no undepleted reserves were available, as would usually be the case in atomic attack. It may be, then, that the ranges for breakpoints from attack to defense during the first few days of an engagement more accurately describe the lower limits of effectiveness of atomic attack.

Some evidence for this view can be deduced from combat interviews. It would appear that men are most deeply affected by casualties which they themselves see inflicted. A platoon stops advancing, at least temporarily, when it sees four or five of its members killed by machine-gun fire, but the effect of such an incident would be negligible if witnessed by one man or so. By the same token, heavy losses received in one company are less unsettling to the whole battalion, because unknown to the other battalion components except later by hearsay, than the same number of losses rather widely distributed throughout

the battalion In the latter case, although the number of casualties witnessed by any one individual is small, large numbers of individuals are personally aware that losses have been incurred. If this idea is carried over to the situation following atomic attack on a battalion, one might expect maximum demoralization because casualties will have occurred throughout the target area and no survivor can fail to see with his own eyes evidence of the effects of the explosion.

It is then suggested that the range of casualty percentages for 2- to 4-day breakpoints of category II: 4 to 23 percent (average 15.5) for enlisted men and 7 to 18 (average 12.5) for officers, may be taken as a lower limit for a measure of effectiveness of atomic attack on an infantry battalion which is at full strength and freshly committed to combat or in reserve, on the assumption that resultant temporary disorganization will be swiftly exploited.

The establishment, from data drawn from conventional warfare, of a casualty level at which complete demoralization of a battalion is achieved by atomic attack alone is more difficult. Battalions at breakpoints in category III were close to complete demoralization, but, as has been pointed out, their condition is believed to have been at least partly a function of the duration of the engagement, that is, of an attrition factor not inherent in atomic attack. One may surmise that the upper limits of the range for cumulative losses, in percent, associated with the earliest appearances of this type of breakpoint (42 to 71 percent for enlisted men, 29 to 63 for officers) would be required to cause complete demoralization by atomic attack in the first days of an engagement.

Only one instance was found of the type of breakpoint most directly comparable to atomic attack—an attacking battalion which broke directly to collapse on the second day of an engagement. The unit was reported to have ceased to exist as a fighting unit, incapable even of defense, when it had lost 48.23 percent of its enlisted men and 44.5 percent of its officers (46.35 percent and 35.5 percent respectively, occurring on the day of breakpoint). Since it had only 75 percent of authorized strength at the start, the effective loss percentages for a full-strength unit may be considered to have been somewhat higher.

On the other hand, two attacking battalions in the first three days of an engagement incurred the following losses: (1) enlisted men 38.33 percent, officers 29.57 percent in two days; (2) enlisted men 47.07 percent, officers 12.05 percent in three days. Neither battalion suffered any discernible disorganization, and both were able a few days later to hold their sector against the German breakthrough into the Ardennes long enough to cover withdrawal of other elements of their division. Admittedly, these battalions were components of a particularly "good" division, which, moreover, had not been in active offensive for $2\frac{1}{2}$ months.

From the data used in this study it seems impossible to set a more definite measure for the effectiveness of atomic attack on a US infantry battalion than to suggest a range of 4 to 23 percent as a lower limit, applicable only if very rapid exploitation can complete the demoralization of the unit; and something above 50 percent as the mean casualty level in a range of perhaps 40 to 70 percent necessary to destroy the unit's effectiveness outright. It should, of course, be noted that these percentages apply to units not long enough in combat to be already affected by attrition. Presumably the effective loss percentages would be appreciably lower for a battalion already battle weary, even if its numerical strength had been restored by replacements.

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OTHER FACTORS INFLUENCING COMBAT EFFECTIVENESS

One fact stands out. No matter what analysis may be made of the casualty data, individual differences in the ability of units to carry out their missions cannot be entirely explained on the basis of casualties and replacements alone. Why, for example, should one battalion have to be withdrawn from active defense when it had suffered a cumulative net loss of 2.5 percent (cumulative casualty total, 30.5 percent) when another had to be withdrawn only after it had suffered 84.2 percent cumulative losses with no replacements?

Clearly the explanation of such divergent battalion experiences lies in some other factor or factors not reflected in these casualty data. Some of the contributing factors that became evident in the course of the study are listed below.

No attempt will be made to establish the relative contribution of these factors to specific breakpoints. The records are in most cases too scanty to supply more than illustrative examples, and to allow the formation of general impressions about the significance of some of the factors in entire engagements.

1. Condition of Troops at the Beginning of the Engagement (Training, Experience, Strength). Within this heading are included such elements as the following:

   (a) Months of combat experience.
   The seven divisions whose battalions participated in the engagements studied had had combat experience as follows:

Combat Experience	No. of Divisions
None	1
1 month	2
7 weeks	1
3 months	1
7 months	1
22 months	

   (b) Length of rest period or service in an inactive sector just prior to the engagement.

The divisions studied had had the following respites:

Interval	No. of Divisions
5 to 7 days rest	2
2 weeks in inactive sector	1
1 month in inactive sector	1
1 ½ months in static defense	1
About 5 weeks travelling across France against little enemy opposition	1
Many months of training	1

(c) Nature of the unit's latest combat experience.

One division had had no previous combat experience; four had experienced very heavy fighting and high losses and two of these had made a poor showing in what was their first combat experience. Two had experienced very heavy fighting but had had a long period of relative inaction thereafter.

(d) Actual unit strength in relation to authorized strength at beginning of engagement.

Of the 31 battalions experiencing breakpoints, one was 75 percent of authorized strength, the others 90 percent or higher.

(e) Number of new replacements in the unit at the start of the engagement.

One division consisted entirely of green troops; four are known to have contained a large number of new replacements which had had to be absorbed in a week's time. The other two had had ample time and opportunity to absorb replacements.

(f) Previous combat experience in the kind of terrain and climate in which the unit was being committed. (A unit experienced in desert warfare in North Africa might, for instance, have difficulty in adjusting to its first experience with Italian mountains.)

Aside from the one inexperienced division, all the others had fought in western Europe, although one was facing its first experience with hedgerows.

(g) Previous unit training for some special type of service, for example, airborne operations, and the pertinence of this training to the engagement at hand.

Two battalions had been trained as part of an airborne division but fought as regular infantry in the engagement studied.

(h) Previous unit training for any special type of situation involved in the impending engagement.

Two of the engagements included river crossings for which the participating units had had no training or practice.

2. Unusual Environmental Stresses. A unit which might still be able to carry out its mission in fair weather and level terrain might be unable to continue under the added stresses of cold, rain, and mountainous country. Three of the seven engagements studied were fought in snow and freezing rain; one in a region of swamps and hedgerows.

3. <u>The Imperative of the Assigned Mission</u>. The degree of urgency of the mission assigned a unit may be assumed to influence its determination to carry out the order. If the order is to take an objective regardless of cost or to hold to the last man, this factor certainly must influence the implementing decisions of battalion and company officers who have to answer for any failure. To what extent such imperatives affect the individual soldier is unknown. It seems possible that the nature of the order and the manner in which officers transmit it downward may have sufficient influence to account for the willingness of some units to continue their mission at least for a time despite loss percentages at which other units break. It may be suspected that, as long as the unit is a well-integrated group, the consciousness that much depends on them may buttress their stamina and determination; but, as soon as disorganization sets in, self-preservation becomes the overpowering motive for each individual.

4. <u>Morale</u>. This nebulous and overworked term is used here to cover:
  (a) The emotional set of troops toward what they believe to be the political purposes of the war; that is, the "political climate" of the unit. This factor had a demonstrable influence in the closing days of World War II when some German units, recognizing that the war was hopelessly lost, retreated or surrendered without a struggle, and others, seeing no acceptable future under the Allied "unconditional surrender" policy, chose to postpone the surrender as long as possible by resisting to the end.
  (b) <u>Esprit de corps</u>, the degree of pride and confidence which a unit feels in its reputation as an able or elite group or in its ability to establish such a reputation. The German SS or Soviet Guard divisions or, in this study, the 17th Airborne and 2d Divisions are examples of units in which <u>esprit de corps</u> was strong.

5. <u>Leadership</u>. This is a major factor. So far as influence on the breakpoints of a battalion is concerned, the leadership of its own officers, including those of company level, is probably more significant than the leadership evidenced at regimental or division level, because at the time of an impending breakpoint a battalion may often be temporarily out of touch with higher headquarters. The records studied include instances in which prompt and vigorous action by officers—usually at company level or below—prevented unauthorized withdrawal and stimulated troops to attack. In other situations, battalion officers rallied and reorganized demoralized units as they fled to the rear. Contrariwise in another engagement a few officers became psychoneurotic cases and either disappeared from the CP or were unable to perform their duties. The appearance of the "emergent leader," who of his own volition assumes authority in an emergency, may be an important element.

6. <u>Tactical Plan</u>. A unit may be unable to carry out its mission if the tactical plan, or the implementation of the plan, is poorly conceived. Defects in tactics may, of course, occur at any level with the possibility of equally disastrous effects on an infantry battalion. The 28th Division engagement, for example, "ordered by higher authority," was for several days the only offensive action taking place on the entire western front. The result was that large German reserves, not being needed elsewhere, were brought in from three directions. The 30th Division met the desperate situation of the German counter-

attack toward Avranches by the possibly unwise expedient of separating companies from their organic battalions and either using them independently or attaching them to other battalions. In the 4th Division engagement studied, the Commanding Officer of the 22d Regiment was removed because he had repeatedly ordered withdrawals which Division Headquarters felt were unjustified.

7. Reconnaissance. From the engagements studied, it was obvious that lack of reconnaissance prior to the engagement may seriously affect the outcome of battle because both terrain and enemy strength and positions are inadequately known. The 30th Division at Mortain, for example, was hit by the German counterattack toward Avranches on 7 August 1944 before it had had time to perform any reconnaissance from the positions of the 1st Division into which it had moved the day before. One of the major reasons for the disastrous outcome of the 28th Division engagement was the failure to discover in advance that the road selected from the map as the MSR was in fact a narrow winding steep trail, barely passable in good weather.

8. Enemy Opposition. The opposing enemy forces may prove to be too strong to be handled by the units committed or in reserve. G-2 intelligence prior to the engagement may have been inadequate or misinformed, or the enemy may have brought in unexpected reinforcements during the engagement. Enemy tactics or weapons with which a unit is unfamiliar may weaken its resistance. For example, the 4th Division in the engagement studied met German heavy tanks for the first time. Or, conversely, enemy opposition may suddenly crumble and a depleted unit find itself able to advance with little difficulty.

9. Fire Support and Reinforcement. Operations plans integrate troop movements with fire support from infantry weapons, artillery, armor, and air. A unit may be unable to reach its objective if one or more of the supporting elements is unable to function for any reason such as enemy action, bad weather, or ineptness, or if the supporting fire is inaccurate, inadequate, or slow.

It seems certain that fire support is one of the major factors which influences the ability of an infantry battalion to carry out its mission. Unfortunately it is almost impossible to discover from records what types of fire and how much were provided at a given time in direct support of a specific infantry battalion; and it is impossible to evaluate the effectiveness of this and other indirect support in weakening the opposition which the battalion faces.

Again, a breakpoint may be averted by the timely arrival of a reinforcing infantry unit. An officer of the 2d Battalion, 22d Infantry, 4th Division, for example, stated that on a day when E Company had lost all its officers, G Company had been "pretty well shot up," and F Company was bearing the brunt of the enemy's counterattack, the 3d Battalion opportunely came up. "This," he said, "was the only thing that saved us." In a few hours both battalions were on the offensive.

Direct reinforcement is, of course, only one aspect. None of these battalions fought alone and their effectiveness was to some undeterminable degree influenced by the success or failure or simply by the movements of companion units.

10. Logistical Support. A unit may be obliged to abandon its mission because it runs out of ammunition or POL; or a unit's own actions may cause logistical failures; or service units may be unable to furnish such services as maintenance or transportation.

In the engagements studied there is no evidence of serious supply shortages of degree . duration sufficient to have had a major influence on breakpoints, although it is clear that strenuous or even desperate efforts were sometimes required to keep the supply lines open and to deliver what was needed. One battalion, failing all other means, sent an ambulance to the rear to bring up ammunition. After forward units of the 9th Division had crossed the Meuse, supplies were man-packed for most of one day over the one intact catwalk bridging the river.

11. Communications. Signal Corps maintains that a unit in combat is never wholly without communications. It may be true that complete loss of all communications is rare, but some degree of failure frequently occurs, through loss of one or more means of communication resulting in loss of lateral contact (with adjacent units) or vertical contact (with units to the front or rear). More or less drastic failure in communications marked all the breakpoints studied, usually preceding and often contributive but apparently never the decisive factor. Wires were repeatedly shot out; radios were destroyed, broke down, their batteries wore out, or terrain and weather hampered their operation; messengers became casualties or wandered about for hours trying to find headquarters.

Loss of contact with higher headquarters not only prevents the transmission of orders but also cuts out the possibility of close and prompt support, and prevents the summoning of reinforcements. Supplies could be obtained only if the isolated units were themselves able to send transport, get a messenger through with a request, or if rear echelons took the initiative in sending them forward. Because artillery networks appear to have been the most dependable communications channel, artillery support was often available when no other help could be secured, but even these sometimes failed. To reestablish contact devious hookups were somet' nes con...ived. For example, a company of the 2d Battalion, 112th Regiment, 28th Division, had to relay through two other companies to reach battalion headquarters. At the same time Battalion Headquarters were maintaining contact with regiment thanks only to a radio operator in the I&R platoon of another battalion who happened to discover their plight and moved in with his instrument until regular channels were re-established.

The commanding officer of the 3d Battalion (17 A/B Division, 513 Regiment) in the Ardennes Salient had, by midafternoon of 7 January 1945, lost all wire and radio contact laterally and to the rear. He kept in touch with the companies under his command by runners and by yelling and waving his arms. Supporting artillery in the meantime fired according to their own estimates of the troops' positions and needs. The battalion was able to continue its attack and to secure its objective by nightfall On the following day, lateral and rear contact from Battalion Headquarters was sporadic until noon and then was lost completely for about 13 hours until a radio could be put back into operation. The order to withdraw then reached the battalion, about 9 hours after the decision had been reached at Division Headquarters. This is the longest p. ic of complete loss of contact with other units reported in the engagements studied. In the case of a unit so isolated, the factor of leadership within the unit obviously assumes great importance.

Because communications in atomic warfare may be suddenly and drastically severed, evaluation of the magnitude of this factor of loss of communications in destr , ing the combat effectiveness of a unit is particularly needed.

In the situations studied it appeared that—of the variables other than casualties—leadership, firepower and reinforcement, and communications were the most frequent and powerful influences affecting the ability of an infantry battalion to carry out its mission.

CONCLUSIONS

The statement that a unit can be considered no longer combat effective when it has suffered a specific casualty percentage is a gross oversimplification not supported by combat data.

Casualties can be taken as a significant measure of loss of combat effectiveness only if the proper defining and limiting factors are specified.

1. The type and size of unit must be stated.

2. Because of the wide variations in data, average loss percentages alone have limited meaning.

3. Ranges of loss percentages must be used to give an accurate description of what happens in actual combat.

4. Loss of combat effectiveness is defined as the inability of a unit to fulfill its mission, but the nature of the mission must be specified. Widely differing ranges of loss percentages are associated with a breakpoint from attack to defense and a breakpoint from defense to withdrawal.

5. The time basis on which loss percentages are figured must be specified —cumulative, on day of breakpoint, or whatever.

Loss percentages analyzed in relation to duration of time from start of engagement to breakpoint proved to be the most meaningful approach to interpretation of casualty data. The arrival of replacements and the increasing magnitude of attrition factors are functions of the duration of the engagement and should not be ignored in connection with conventional warfare.

The following conclusions are drawn from the experience of US infantry battalions in the ETO in World War II. It is not known whether ranges of loss percentages of similar magnitude appear in other theaters or other wars.

In the first few days of an engagement two categories of breakpoint may occur: (I) attack→rapid reorganization→attack; (II) attack→defense. Category I is associated with cumulative losses in enlisted men in the range* of 13 to 34 percent; II with a range of 4 to 23 percent; with slightly lower ranges for officer casualties. Virtually no replacements are received in this period. I is distinguished from II by high losses on the day of breakpoint.

In the second week, average cumulative net losses for category II breakpoints are almost identical with average cumulative losses for category II in the first week; that is, battalions broke from attack to defense at the same average level of strength in both time periods. Average cumulative casualties

*Based on one standard deviation from the mean of the sample.

in the second week are similar for both categories I and II (28-30 percent for enlisted men, 41 percent for officers), but I is distinguished from II by a somewhat larger average replacement of enlisted men and a more than complete replacement of officers.

The appearance in the second week of a third category of breakpoint—defense→withdrawal by order—suggests that this type of breakpoint is a function of duration of the engagement. The ranges of cumulative losses associated with this category of breakpoint in the second week are: enlisted men, 42 to 71 percent, officers, 29 to 63 percent; few replacements had been received.

In the third week of engagement the effects of attrition factors are clear. Rapid reorganization for renewed attack is no longer possible; no examples of category I breakpoints appear. Battalions had to be withdrawn from active defense (category III breakpoint) despite the fact that replacements had reduced their cumulative net losses in enlisted men to a range of 8 to 17 percent, officers 5 to 11 percent.

Proportionately higher losses in officers than in enlisted men are not characteristic of breakpoints. In all of the logical presentations of the data in relation to breakpoints used, losses in officers are almost always somewhat lower proportionately than losses in enlisted men.

Extrapolation from the most pertinent casualty data in conventional warfare suggests that losses of 4 to 23 percent for enlisted men and 7 to 18 percent for officers may be taken as a measure of effectiveness of atomic attack on an infantry battalion which is fresh and at full strength, assuming that the resultant temporary demoralization will be swiftly exploited by conventional means. Complete demoralization of a fresh infantry battalion at full strength, by atomic attack alone, may be achieved by the infliction of losses in the range of 40 to 70 percent.

The very wide individual differences in the ability of infantry battalions to carry out a given mission cannot be accounted for in terms of casualties alone, no matter how the data are presented.

Of the variables other than casualties which may affect the ability of an infantry battalion to carry out its mission, it is believed that failures and breakdowns in leadership, fire support and reinforcement, and communications are the most frequent and powerful influences.

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APPENDICES

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Appendix A

EXAMPLE OF DISTRIBUTION OF CASUALTIES
IN AN INFANTRY DIVISION
(28th Division, Schmidt Campaign, 1-14 November 1944)

On 14 November the 28th Division was reported destroyed as a fighting machine.

TABLE A1

DISTRIBUTION OF CASUALTIES IN AN INFANTRY DIVISION

1. Effective Strength at Start of Engagement, 012400 November

Units	EM	O	Total
Division	13,107	825	13,932
Attachments	2,173	111	2,334
Total	15,230	936	16,266

2. Casualties (Battle and Non-Battle), 2 to 13 November inclusive

Organic Units	EM	O	Total	% of Total Casualties in Div and Attchmts	% of Div and Attchmts Strength as of 012400 November
Inf Regt (3)	4321	205	4526	93.19	27.82
Div Arty (4 Bn)	67	7	74	1.52	.45
Engr C Bn	43	1	44	.91	.27
Med Bn	6	1	7		
Sig Co	1		1		
Ord Co	1		1		
Rcn Troop	10		10	.49	.15
QM Co	2		2		
MP Plat	2		2		
Band	1		1		
Subtotal	4454	214	4668		
Attachments					
Tank-Destroyer Bn	76	4	80	1.65	.49
AA Bn	5	2	7	.14	.04
Tank Bn	98	4	102	2.10	.63
Subtotal	179	10	189		
Total	4633	224	4957	100.00	29.85

TABLE Ai (continued)

3. Replacements and Returnees by Day of Battle

Date	Organic Units[a]		Attachments[b]	
	EM	O	EM	O
Nov 2	2			
3	372			
4	10		1	
5	11		1	
6	333	8	13	
7	313	1	17	2
8	739	38		
9	115	1		
10	472	9	10	2
11	490	11	5	
12	747	29	2	
13	124	18	7	
Total	3728	115	56	4

[a] 82.33 percent of Division casualties replaced.
[b] 31.75 percent of Attachment casualties replaced.

Appendix B

ENGAGEMENTS STUDIED

1. <u>7 to 15 July 1944</u> - Attack north of Carentan toward Periers, Normandy

    4th Division: 22d Regt, Bn 1, 2, 3

    The Division experienced a period of hard fighting in a region of hedgerows and swamps.

2. <u>6 to 12 August 1944</u> - Mortain, France

    30th Division: 117th Regt, Bn 1, 2, 3
    119th Regt, Bn 1, 2, 3
    120th Regt, Bn 1, 2, 3

    The Division, which had just moved into position around the town of Mortain, was hit by the German counterattack toward Avranches. One battalion, 2d/117th, although surrounded, held its hill positions throughout the period.

3. <u>4 to 7 September 1944</u> - Meuse River Crossing

    9th Division: 39th Regt, Bn 1, 2, 3
    47th Regt, Bn 1, 2, 3
    60th Regt, Bn 1, 2, 3

    The Division crossed the Meuse River near Dinant and cleaned out the east bank against heavy German opposition.

4. <u>4 to 27 September 1944</u> - Moselle River Battle in Vicinity of Toul, France

    80th Division: 317th Regt, Bn 1, 2, 3
    318th Regt, Bn 1, 2, 3
    319th Regt, Bn 1, 2, 3

    The engagement includes an unsuccessful and a successful attempt to cross the Moselle River and the subsequent reduction of the German forces on the east banks.

5. <u>1 to 14 November 1944</u> - Schmidt Campaign

    28th Division: 109th Regt, Bn 1, 2, 3
    110th Regt, Bn 1, 2, 3
    112th Regt, Bn 1, 2, 3

    The 28th Division attacked alone in an unsuccessful effort to take the town of Schmidt in the Huertgen Forest, Germany.

6. 13 to 21 December - Ardennes

2d Division: 9th Regt, Bn 1, 2, 3

During the first four days the Division was attacking successfully toward the Rhine. It was then hit by the German Ardennes offensive. The 18 hours during which the Division held its position while other units withdrew are considered decisive in preventing a widening of the German breakthrough.

7. 3 to 10 January 1945 - Battle of Dead Man's Ridge, Ardennes Salient

17th Airborne Division: 513 Parachute Regt, Bn 1, 2*

The regiment, with other units, attacked to reduce the Ardennes salient formed during the German breakthrough in December. It was hit by a powerful German counterattack.

*Morning Reports for Bn 3 incomplete.

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Appendix C

Casualties at Breakpoints by Individual Battalion

Unit (Div/Regt/Bn)	Date of breakpoint	Day of engagement on which breakpoint occurred	Cumulative casualties (%) from start of engagement to breakpoint		Cumulative casualties (%) for 2 days preceding plus day of breakpoint		Casualties (%) on day of breakpoint	
			EM	O	EM	O	EM	O
Category I (Attack → Reorganization → Attack)								
4/22/2d	10 July 1944	4	32.90	27.80	31.37	27.06	14.51	14.71
30/117/1st	7 Aug 1944	2	32.61	31.04	32.61	31.04	32.13	27.59
30/117/2d	7 Aug 1944	2	21.13	9.90	21.13	9.90	20.60	6.67
30/119/1st	8 Aug 1944	3	9.73	3.03	9.73	3.03	6.62	0.00
9/47/1st	6 Sep 1944	3	11.59	8.57	11.59	8.57	11.17	8.57
80/318/3d	13 Sep 1944	10	26.00	9.00	12.85	12.50	11.22	12.50
80/317/1st	14 Sep 1944	11	14.50	16.30	8.61	6.36	2.15	0.00
80/317/3d	14 Sep 1944	11	43.90	37.00	15.66	15.36	8.88	5.88
17AB/513/1st	4 Jan 1945	2	31.06	31.11	31.06	31.11	30.48	31.11
Category II (Attack → Defense)								
4/22/1st	12 July 1944	6	27.60	57.60	18.10	41.33	3.29	8.33
4/22/2d	12 July 1944	6	49.50	51.00	31.28	37.38	7.78	13.79
4/22/3d	14 July 1944	8	31.80	25.90	13.01	3.23	1.10	0.00
30/120/1st	7 Aug 1944	2	13.74	11.76	13.74	11.76	10.96	11.76
80/317/1st	6 Sep 1944	3	2.95	6.45	2.95	6.45	1.61	0.00
80/317/2d	6 Sep 1944	3	5.28	9.90	5.28	9.90	3.54	6.67
80/317/3d	6 Sep 1944	3	22.87	18.38	22.87	18.38	21.70	12.50
80/319/3d	6 Sep 1944	3	4.83	15.74	4.83	15.74	1.51	0.00
80/318/2d	13 Sep 1944	10	27.20	16.50	4.52	2.38	3.10	2.38
80/319/3d	20 Sep 1944	17	24.00	34.00	14.06	9.28	10.48	6.25
80/317/3d	23 Sep 1944	20	73.00	59.10	6.41	6.26	3.97	3.13
80/318/2d	24 Sep 1944	21	55.50	28.50	15.62	9.76	10.00	9.76
80/318/3d	25 Sep 1944	22	64.80	91.50	16.39	12.13	5.59	6.25
28/110/3d	3 Nov 1944	3	19.44	12.65	19.44	12.65	7.87	6.45
28/109/1st	4 Nov 1944	4	29.80	22.00	26.20	19.73	7.02	2.70
28/112/1st	4 Nov 1944	4	9.60	6.00	9.12	5.88	3.00	0.00
28/109/3d	6 Nov 1944	6	35.50	25.50	14.66	11.77	6.55	6.06
28/110/1st	6 Nov 1944	6	18.00	17.50	16.1	7.30	3.50	3.10
28/110/2d	6 Nov 1944	6	19.90	7.50	6.43	4.87	2.21	4.87
28/110/1st	10 Nov 1944	10	32.00	20.50	9.70	7.90	5.80	0.00
17AB/513/2d	4 Jan 1945	2	13.22	8.51	13.22	8.51	11.17	8.51

Casualties at Breakpoints by Individual Battalion (continued)

Unit (Div/Regt/Bn)	Date of breakpoint	Day of engagement on which breakpoint occurred	Cumulative casualties (%) from start of engagement to breakpoint		Cumulative casualties (%) for 2 days preceding plus day of breakpoint		Casualties (%) on day of breakpoint	
			EM	O	EM	O	EM	O
Category III (Defense → Withdrawn by order)								
80/318/3d	17 Sep 1944	14	37.80	65.00	9.27	24.55	0.15	3.23
80/317/1st	18 Sep 1944	15	50.50	37.00	31.49	17.41	17.54	7.41
80/319/1st	20 Sep 1944	17	17.80	24.01	4.62	3.23	1.54	0.00
28/110/3d	8 Nov 1944	8	30.50	42.80	3.96	30.15	0.27	0.00
28/112/1st	8 Nov 1944	8	56.50	67.50	43.59	60.88	36.81	38.46
28/112/2d	8 Nov 1944	8	51.20	39.20	30.25	21.88	1.91	0.00
28/112/3d	8 Nov 1944	8	67.50	67.20	51.93	47.83	43.14	41.38
28/110/1st	13 Nov 1944	13	63.50	54.50	31.80	34.10	10.00	4.70
2/9/1st	18 Dec 1944	6	84.20	62.00	40.66	30.16	34.66	16.00
2/9/3d	18 Dec 1944	6	49.50	44.80	22.44	21.31	3.42	0.00
2/9/2d	19 Dec 1944	7	57.30	12.00	6.81	0.00	2.50	0.00
17AB/513/2d	8 Jan 1945	6	59.50	39.00	40.12	23.71	12.07	8.57
17AB/513/1st	9 Jan 1945	7	54.30	48.20	17.79	13.70	2.87	0.00

Appendix D

Net[a] Casualties at Breakpoints by Individual Battalion

Unit (Div/Regt/Bn)	Date of breakpoint	Day of engagement on which breakpoint occurred	Cumulative net casualties (%) from start of engagement to breakpoint		Cumulative net casualties (%) for 2 days preceding plus day of breakpoint		Net casualties (%) on day of breakpoint	
			EM	O	EM	O	EM	O
Category I (Attack → Reorganization → Attack)								
4/22/2d	10 July 1944	4	32.47	19.00	30.94	18.97	14.08	5.88
30/117/1st	7 Aug 1944	2	26.57	27.59	26.57	27.59	26.21	27.59
30/117/2d	7 Aug 1944	2	13.80	9.90	13.80	9.90	20.22	6.67
30/119/1st	8 Aug 1944	3	9.37	3.03	9.37	3.03	6.38	0.00
9/47/1st	6 Sep 1944	3	9.60	−0.62	9.60	−0.62	11.03	8.57
80/318/3d	13 Sep 1944	10	13.60	−18.04	8.63	−23.79	9.46	12.50
80/317/1st	14 Sep 1944	11	7.50	2.30	8.24	6.36	2.33	0.00
80/317/3d	14 Sep 1944	11	7.30	4.30	10.32	−0.67	8.21	5.88
17AB/513/1st	4 Jan 1945	2	31.05	31.11	31.06	31.11	30.48	31.11
Category II (Attack → Defense)								
4/22/1st	12 July 1944	6	19.10	50.50	10.50	34.21	3.16	8.33
4/22/2d	12 July 1944	6	24.80	38.60	6.39	25.60	7.78	10.34
4/22/3d	14 July 1944	8	14.30	19.80	−4.37	−0.10	−0.54	0.00
30/120/1st	7 Aug 1944	2	12.95	11.76	12.95	11.76	10.50	11.76
80/317/1st	6 Sep 1944	3	2.82	6.45	2.82	6.45	1.48	0.00
80/317/2d	6 Sep 1944	2	4.52	9.90	4.52	9.90	3.03	6.67
80/317/3d	6 Sep 1944	3	21.83	15.26	21.83	15.26	21.18	9.38
80/319/3d	6 Sep 1944	3	3.97	15.74	3.97	15.74	1.38	0.00
80/318/2d	13 Sep 1944	10	8.00	−40.26	−4.48	−44.59	2.96	2.38
80/319/3d	20 Sep 1944	17	10.50	12.50	13.69	9.28	10.11	6.25
80/317/3d	23 Sep 1944	20	−14.20	6.60	−5.72	3.03	0.48	3.13
80/318/2d	24 Sep 1944	21	14.70	−33.06	9.31	9.76	5.35	9.76
80/318/3d	25 Sep 1944	22	13.00	−4.77	4.28	9.01	4.61	3.13
28/110/2d	3 Nov 1944	3	13.86	3.10	13.86	3.10	2.29	0.00
28/109/1st	4 Nov 1944	4	21.80	7.00	18.40	12.27	4.09	0.00
28/112/1st	4 Nov 1944	4	7.00	2.80	6.47	2.75	5.00	−3.13
28/109/3d	6 Nov 1944	6	29.20	11.20	10.50	2.77	4.73	0.00
28/110/1st	6 Nov 1944	6	4.70	14.50	11.91	14.48	−0.14	3.10
28/110/2d	6 Nov 1944	6	12.50	−3.30	2.59	2.37	−0.74	4.87
28/110/1st	10 Nov 1944	10	6.50	14.20	−2.20	−.23	5.56	0.00
17AB/513/2d	4 Jan 1945	2	12.73	8.51	12.73	8.51	10.68	8.51

Net[a] Casualties at Breakpoints by Individual Battalion (continued)

Unit (Div/Regt/Bn)	Date of breakpoint	Day of engagement on which breakpoint occurred	Cumulative net casualties (%) from start of engagement to breakpoint		Cumulative net casualties (%) for 2 days preceding plus day of breakpoint		Net casualties (%) on day of breakpoint	
			EM	O	EM	O	EM	O
Category III (Defense → Withdrawn by order)								
80/318/3d	17 Sep 1944	14	6.30	−6.90	−9.50	2.57	−6.07	0.00
80/317/1st	18 Sep 1944	15	38.00	20.00	25.80	13.96	14.91	7.41
80/319/1st	20 Sep 1944	17	6.20	11.86	0.63	0.00	0.19	0.00
28/110/3d	8 Nov 1944	8	2.50	33.20	−18.68	30.15	−0.40	0.00
28/112/2d	8 Nov 1944	8	36.00	30.00	23.66	21.88	0.69	0.00
28/112/3d	8 Nov 1944	8	62.00	67.20	48.99	47.83	41.92	41.38
28/110/1st	13 Nov 1944	13	0.00	0.00	−5.50	−7.43	0.67	−33.33
2/9/1st	18 Dec 1944	6	84.20	58.80	40.66	30.16	34.56	16.00
2/9/3d	18 Dec 1944	6	49.20	44.80	22.07	21.13	3.42	0.00
2/9/2d	19 Dec 1944	7	55.60	5.30	6.81	−6.66	2.60	−6.66
17AB/513/2d	8 Jan 1945	6	56.30	39.00	38.07	23.71	12.07	8.57
17AB/513/1st	9 Jan 1945	7	52.80	44.30	16.31	10.00	2.87	0.00
28/110/3d	8 Nov 1944	8	2.50	33.20	−18.68	30.15	−0.40	0.00
28/112/1st	8 Nov 1944	8	48.70	57.50	39.00	54.82	34.76	38.46
28/112/2d	8 Nov 1944	8	36.00	30.00	23.66	21.88	0.69	0.00

[a]Casualties minus replacements